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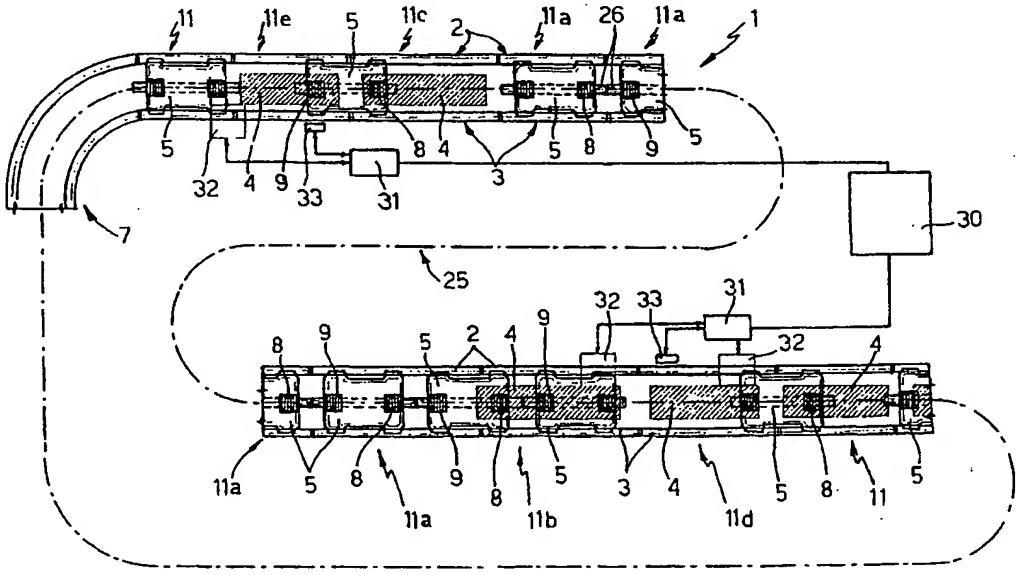
(54) Title: INTEGRATED CONVEYOR SYSTEM FOR MOVING LOADS, IN PARTICULAR VEHICLES, ALONG A PRODUCTION LINE



(57) Abstract: The integrated conveyor system has a number of independent powered modules (11), each having a pair of rails (2, 3), and a powered belt (4) stretched in the transverse space defined between the pair of rails and forming a continuous support and guide structure and along which run a number of trucks are moved by the belt of each module along the rails. The conveyor system also includes a number of modules having no powered belt, a push module (116) having a powered belt and a brake module (11c) having a nonpowered belt; the trucks having stop means for forming, a train of mutually contacting trucks between the push module and the brake module, and pushed by the powered belt of the push module.

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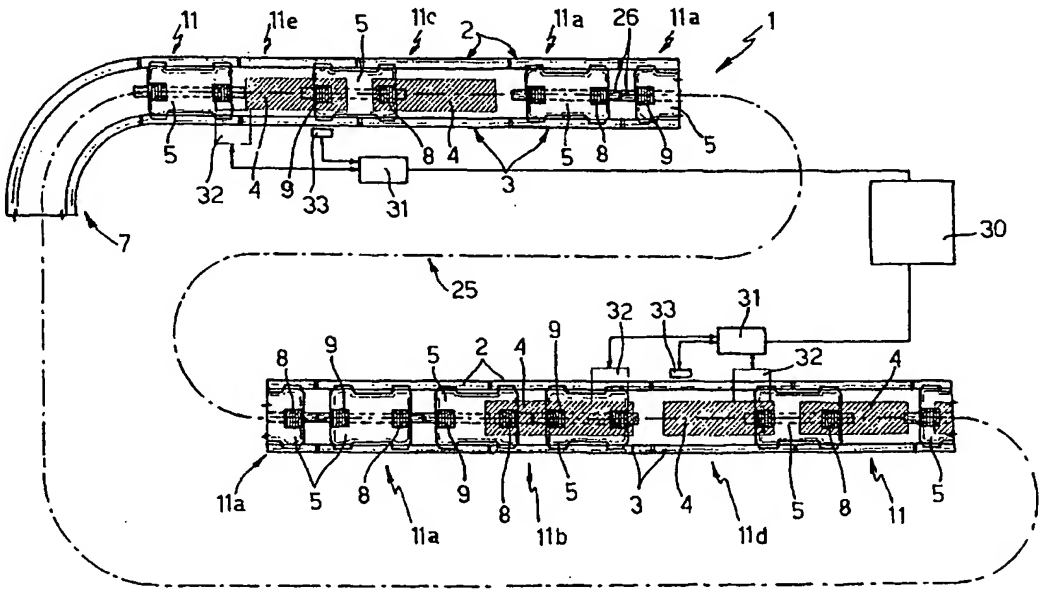
(54) Title: INTEGRATED CONVEYING SYSTEM FOR CONVEYING LOADS, IN PARTICULAR VEHICLES, ALONG A PRODUCTION LINE



(57) Abstract: The integrated conveyor system has a number of independent powered modules (11), each having a pair of rails (2, 3), and a powered belt (4) stretched in the transverse space defined between the pair of rails and forming a continuous support and guide structure and along which run a number of trucks are moved by the belt of each module along the rails. The conveyor system also includes a number of modules having no powered belt, a push module (116) having a powered belt and a brake module (11c) having a nonpowered belt; the trucks having stop means for forming, a train of mutually contacting trucks between the push module and the brake module, and pushed by the powered belt of the push module.

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INTEGRATED CONVEYOR SYSTEM FOR MOVING LOADS, IN PARTICULAR VEHICLES, ALONG A PRODUCTION LINE

TECHNICAL FIELD

The present invention relates to an integrated conveyor system for moving loads, in particular vehicles, along an assembly line.

BACKGROUND ART

European Patent n. 0873271, filed by the present Applicant, and the pertinent parts of which are included herein purely by way of reference, describes a modular conveyor (known commercially as TTS) comprising a number of modules powered by independent motors, and each of which comprises a contoured structure (e.g. extruded, but which can also be formed using steel sections or other methods) defining a pair of rails, and a powered belt stretched inside the transverse space between the pair of rails, over or under the rails. The modules are arranged with the pairs of rails end to end to form a substantially continuous support and guide structure defining an endless path, and along which run a number of trucks, which engage the rails with respective rollers,

constant speed, with the trucks close together in strictly predetermined positions, the above conveyor is unsuitable, in that, to form a "train" of trucks with the above characteristics, the belt speed of the modules forming the production line would have to be controlled and maintained rigorously constant. Though theoretically possible, using special electric motors and sophisticated electronic controls, the cost involved would be so high as to make the system uncompetitive.

In some cases, therefore, the TTS conveyor is currently unsuitable, in terms of cost, for vehicle assembly lines involving a high degree of precision, and is mainly used for other types of transportation and/or as assembly line return lines.

Assembly lines are therefore equipped with conventional conveyors, in which a number of nonpowered trucks or platforms are accumulated to form a "train", which is moved along the assembly line by pushing the last upstream platform in the train (here and in the following description, "upstream" and "downstream" are used with reference to the traveling direction of the movable conveying members, be they trucks or platforms) by means of a push station defined by a number of powered rollers, which frictionally and laterally engage the longitudinal edges of the last upstream, i.e. tail, platform in the train; and the train of trucks/platforms is held together, with the trucks/platforms contacting one another, by a downstream braking station acting on

to engage a second module adjacent to the first, at least one pad of the truck still cooperates with the belt of at least one of said first and second modules; characterized by also comprising:

- a number of modules having no powered belt, and aligned to define a work line; and
- a push module having a powered belt and located at a first end of the work line;
- said trucks having stop means for forming, along said work line and downstream from the push module, a train of trucks contacting one another between said rails; the train of trucks being pushed along at a predetermined speed by the powered belt of the push module only.

The system also comprises a brake module having a nonpowered idle belt, and located at a second end of the work line opposite the first end.

Both the production line and the return line are therefore formed using standard TTS modules, thus reducing the size and cost of the production line rails and the cost of the conveyor system as a whole, by using standard, mass produced components. Moreover, unlike a conventional TTS conveyor, no sophisticated, high-cost electronic control system is required to synchronize the speed of the motors of the TTS modules forming the production line.

Finally, by simply adjusting the vertical travel (to and from the belt) of the truck pads, the thrust imparted

with the pairs of rails 2, 3 end to end to form a support and guide structure 7, which is substantially continuous (except for the small assembly gap between adjacent modules) and forms an endless path of any shape (Figure 1) for a number of trucks 5 which run along pairs of rails 2, 3.

Each truck 5 comprises a number of wheels or rollers 49 idly engaging pairs of rails 2, 3 to guide the truck both transversely and vertically; and at least one pair of grip pads 8 and 9, which, with the aid of push means 10 (Figure 3) defined, for example, by helical springs, selectively engage powered belts 4 of modules 11, and are moved by powered belts 4 of modules 11 in a predetermined direction depending on the traveling direction of belts 4. The powered belt 4 of each module 11 is supported over and connected integrally to rails 2, 3 by a supporting structure 14 (Figure 3) made, like rails 2, 3, preferably, though not necessarily, from extruded metal sections, e.g. of light alloy.

More specifically, in known manner not shown in detail for the sake of simplicity, each structure 14 supports a belt 4 stretched, to form an endless loop comprising two straight branches, between a pair of rotary pulleys 15, 16 (Figures 2 and 4), which are thus carried integrally by respective module 11.

Belts 4 are preferably, though not necessarily, double-toothed belts (Figures 4 and 5), i.e. having a number of transverse teeth 18 formed on an outer face

of belt 4 facing trucks 5 slides smoothly.

Belts 4 are powered by motors 21 (Figure 4), e.g. for driving one of pulleys 15, 16, which, to mesh with the teeth (if any) of belts 4, are preferably, though not necessarily, also toothed. For example, even in the case of belts 4 toothed on both faces, the transmission (nonpowered) pulley may be smooth.

According to the invention, conveyor system 1 also comprises a number of modules 11a having no powered belts 4 or supporting structures 14 (therefore only comprising rails 2, 3), and aligned to define a work line 25 of desired length, of which Figure 1 shows schematically the opposite ends and the intermediate portion indicated by a dot-and-dash line; and a push module 11b (Figures 1 and 2) having a belt 4 powered by a motor 21, and located at the upstream (start) end of work line 25.

Trucks 5 have stop means defined, for example, by the opposite ends of longitudinal bars 26 (Figure 2), to form, along work line 25 and downstream from push module 11b, a train of carriages 5 contacting one another between rails 2, 3 (Figures 1 and 2). According to the invention, the train of carriages 5 is pushed along at a predetermined speed solely by the powered belt 4 of push module 11b, as described in detail later on.

Conveyor system 1 according to the invention also comprises a brake module 11c having an idle belt 4 - i.e. a belt stretched between two pulleys 15, 16 fitted to a structure 14, and having a spacer 20 but no motor 21 -

accelerating station defined by at least one module 11e having a powered belt 4 and located immediately downstream from brake module 11c. Module 11e is identical with module 11d described above, and comprises a substation 31 of central control unit 30; sensors 32 for determining the linear speed of belt 4 of module 11e and, possibly, of brake module 11c; and sensors 33 for determining the presence/absence of a truck 5 along an end portion of the pair of rails 2, 3 of brake module 11c.

The drive means of module 11e thus provide for gradually varying the linear speed of respective powered belt 4 between the speed of idle belt 4 of brake module 11c and the speed of powered belt 4 of the standard module 11 immediately downstream from the accelerating station, within the time interval in which one pad (8) of a truck 5 leaves the idle belt 4 of brake module 11c, and another pad (9) of the same truck 5 engages powered belt 4 of the module 11 immediately downstream from the accelerating station (module 11e).

In other words, electronic control systems 30, 31, 32, 33 selectively ensure only one truck 5 at a time engages belts 4 of the modules defining the decelerating and accelerating stations.

To enable push module 11b to produce sufficient linear thrust to move the train of trucks 5 formed in use along work line 25, module 11b is equipped with additional push means to springs 10 of trucks 5, for

between rails 2, 3 in which pads 8, 9 of trucks 5 run. Though, obviously, other on-truck methods acting on springs 10 may be used.

module only.

2) An integrated conveyor system as claimed in Claim 1, characterized by also comprising a brake module having a nonpowered idle belt, and located at a second end of the work line opposite the first end.

3) An integrated conveyor system as claimed in Claim 1 or 2, characterized in that said powered belts and said idle belt are each stretched, to form an endless loop comprising two straight branches, between two rotary pulleys carried integrally by each module.

4) An integrated conveyor system as claimed in Claim 2 or 3, characterized by also comprising a decelerating station defined by at least one said module having a powered belt and located immediately upstream from the push module; drive means of said at least one module defining the decelerating station gradually varying the linear speed of the respective powered belt between the speed of the powered belt of the immediately upstream module and the speed of the belt of the push module, within the time interval in which one pad of a truck leaves the belt of said module immediately upstream from the decelerating station, and another pad of the same truck engages the belt of said push module.

5) An integrated conveyor system as claimed in one of Claims 2 to 4, characterized by also comprising an accelerating station defined by at least one said module having a powered belt and located immediately downstream from said brake module; drive means of said at least one

Claims 6 and 7, characterized in that said electronic control means selectively ensure only one truck at a time engages the belt of the at least one module defining said deceleration station and said accelerating station.

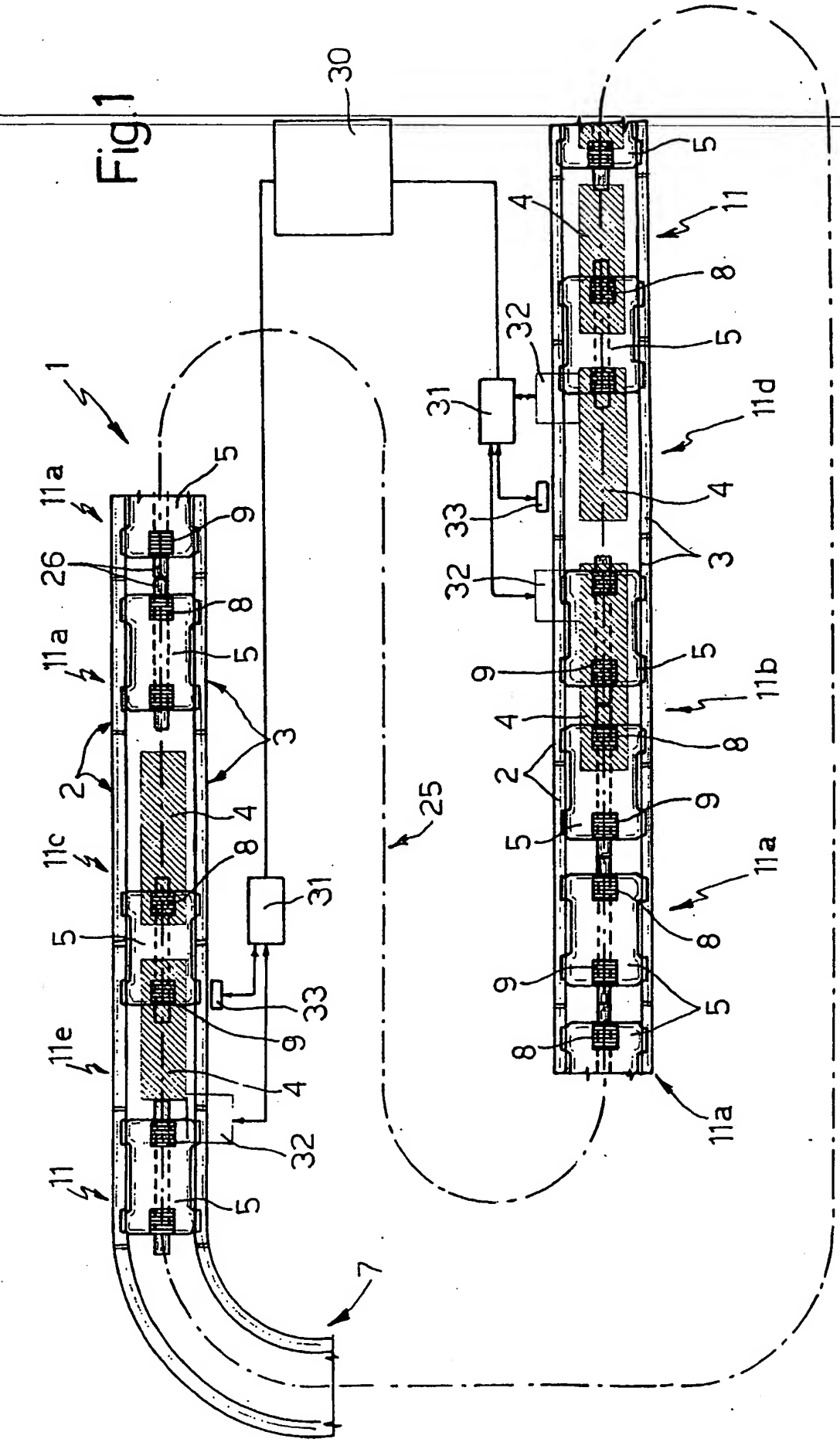
9) An integrated conveyor system as claimed in one of Claims 2 to 8, characterized in that, between respective inner faces of respective branches of each of said powered belts and of said idle belt, there is located a spacer made of antifriction material, and along which slides the inner face of the belt branch facing said trucks.

10) An integrated conveyor system as claimed in Claim 9, characterized in that said powered belts and said idle belt are double-toothed belts; said pads being toothed pads engaging an outer face of a branch of each belt facing said trucks.

11) An integrated conveyor system as claimed in Claim 10, characterized in that said push module comprises, in addition to said powered belt, a second belt, which is stretched between a pair of idle pulleys, has smooth faces, and a branch of which facing said trucks is interposed between the inner face of the corresponding branch of the powered belt of the push module and said spacer of antifriction material.

12) An integrated conveyor system as claimed in Claim 11, characterized in that said push means comprise, for each pad, elastic means for pressing the pad against an outer face of the branch of each belt facing said

Fig1



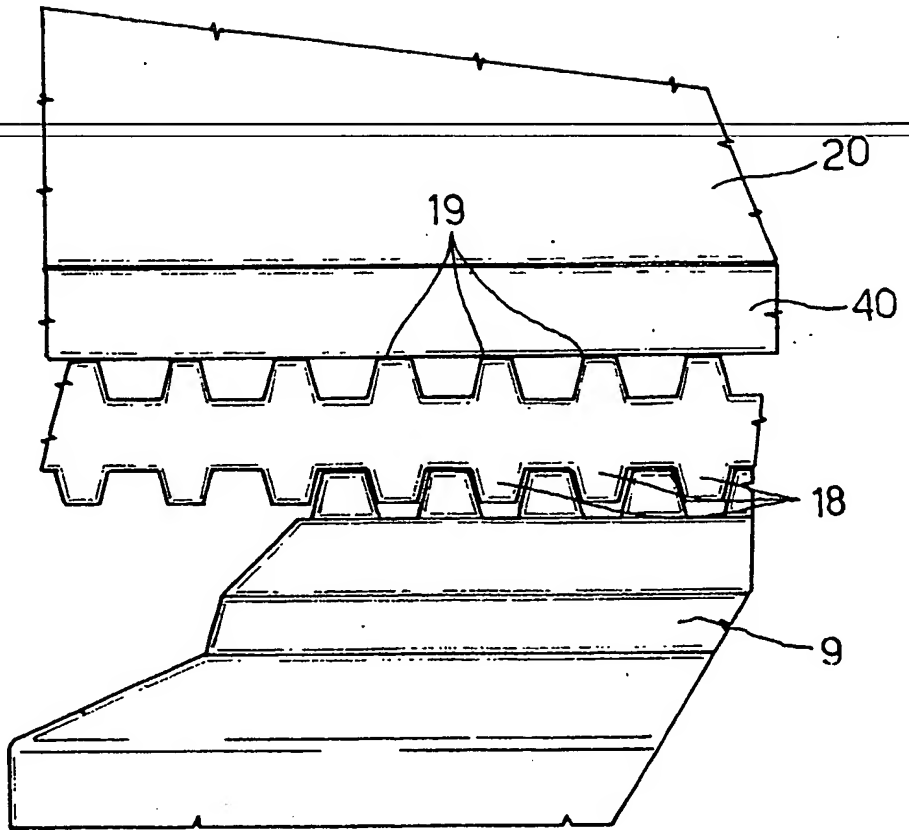


Fig.5

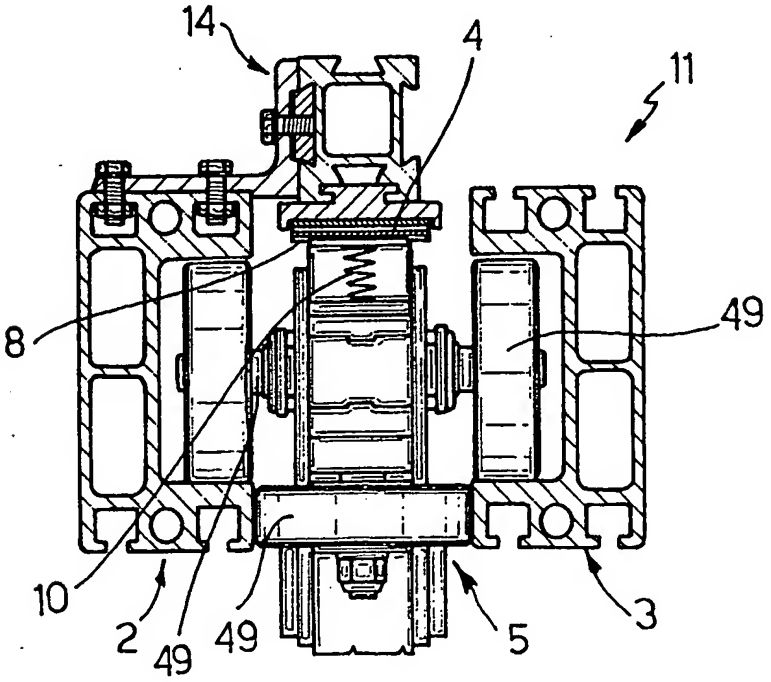


Fig.3

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 873 271 B (CPM S P A) 18 October 2000 (2000-10-18) cited in the application figure 1 column 3, paragraph 12 -column 5, paragraph 23	1,3,10, 12,13
A	US 5 577 593 A (HOOPER RICHARD G) 26 November 1996 (1996-11-26) claims 1-3	4,5
A	US 4 492 297 A (STICHT WALTER) 8 January 1985 (1985-01-08) figure 1 column 4, line 21 -column 4, line 48	1

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